Survey of Physician Diagnostic Practices for Patients with Acute Diarrhea: Clinical and Public Health Implications

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To understand physician practices regarding the diagnosis of acute diarrheal diseases, we conducted a survey, in 1996, of 2839 physicians in Connecticut, Georgia, Minnesota, Oregon, and California. Bacterial stool culture was requested for samples from the last patient seen for acute diarrhea by 784 (44%; 95% confidence interval, 42%–46%) of 1783 physicians. Physicians were more likely to request a culture for persons with acquired immune deficiency syndrome, bloody stools, travel to a developing country, diarrhea for >3 days, intravenous rehydration, or fever. Substantial geographic and specialty differences in culture-request practices were observed. Twenty-eight percent of physicians did not know whether stool culture included testing for *Escherichia coli* O157:H7; 40% did not know whether *Yersinia* or *Vibrio* species were included. These variabilities suggest a need for clinical diagnostic guidelines for diarrhea. Many physicians could benefit from education to improve their knowledge about tests included in routine stool examinations.

In May 1997, a multimillion-dollar food safety initiative was begun, to improve the United States' capacity to detect and respond to foodborne diseases. One goal of the initiative is to enhance surveillance for foodborne diseases through the Foodborne Diseases Active Surveillance Network (FoodNet). This network is the primary foodborne disease component of the Emerging Infections Program of the Centers for Disease Control and Prevention (CDC) and was begun in 1994, in partnership with state health departments, to address emerging infectious diseases in the United States [1–3]. FoodNet is a collaborative effort of the CDC; the state health departments of California, Connecticut, Georgia, Maryland, Minnesota, New York, Oregon, and Tennessee; the US Department of Agriculture, Food Safety and Inspection Service; and the US Food and Drug Administration. The objectives of FoodNet are to determine and monitor the burden of foodborne disease over time, to determine the causes of selected foodborne diseases, and to provide a framework for rapid, collaborative responses to foodborne diseases. FoodNet focuses on diarrheal illnesses, because most foodborne infections cause diarrhea.

FoodNet investigators conducted the present study to determine the diagnostic practices of physicians who treat patients with acute diarrhea. Physicians who request stool specimens from such patients are essential contributors to foodborne disease surveillance that is based on data for laboratory-confirmed cases of food-

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borne infection. However, only a fraction of cases of foodborne disease are reported to the CDC. For example, if a case of diarrhea caused by *Salmonella* infection is to be reported, the patient must first seek medical care, a stool specimen must be obtained and submitted to a laboratory for culture, the laboratory must test for and isolate the organism, and the positive culture result must be reported to a health department and then to the CDC. If any step in this process does not occur, the illness will not be reported. Each reported case of *Salmonella* is estimated to represent 38 unreported cases [4, 5]. Thus, information on the factors that influence physicians' diagnostic choices for patients with diarrhea are needed to understand the strengths and weaknesses of the foodborne disease surveillance system and to better estimate the magnitude of foodborne disease in the United States. To our knowledge, our investigation was the first population-based assessment of US physician diagnostic practices for patients with acute diarrhea and provides data that are relevant to health care providers, public health professionals, and those concerned with the diagnosis and management of acute diarrheal diseases.

METHODS

We conducted a population-based mail survey of physicians in FoodNet surveillance areas (also called "FoodNet sites") to determine what proportion of physicians report requesting stool specimens from patients with diarrhea and what patient and physician characteristics are associated with a stool specimen request. In 1996, the surveillance area of the FoodNet sites included counties in California (Alameda and San Francisco), Connecticut (Hartford and New Haven), and Georgia (Clayton, Cobb, Dekalb, Douglas, Fulton, Gwinnett, Newton, and Rockdale) and the entire states of Minnesota and Oregon. According to the US Census Bureau, the 1996 population estimate for these areas was 14,281,096 persons. All licensed physicians with a nonsurgical specialty who were likely to treat persons with acute diarrhea and who practiced in the surveillance areas were eligible for inclusion. The specialties included were emergency medicine, family practice, general practice, internal medicine (including subspecialties), obstetrics and gynecology, pediatric medicine (including subspecialties), primary care osteopathic physicians, and public health. After 21,653 physicians were identified through state licensure lists, a random sample of ~5000 physicians (1000 in each FoodNet site) was devised, and ~1250 surveys (250 in each site) were mailed during each calendar quarter of 1996. The questionnaire was pretested in each site, and physicians who participated in this preliminary phase were excluded from the data-gathering phase. The goal was to obtain a 60% response rate of completed surveys. Appropriate informed consent was obtained from patients, and the study was conducted in accordance with guidelines for human research as specified by the US Department of Health and Human Services.

The 4-page questionnaire was accompanied by a letter that explained the project and intended uses of the data and a stamped, self-addressed return envelope. No financial incentives were given to respondents, and no personal identifying information was collected with the data. If no response was received in 2 weeks, a second survey was mailed with a similar cover letter. If no response was received in 2 more weeks, a telephone call or facsimile transmission was made, when possible, to verify the mailing address and encourage participation of the nonrespondents before a third mailing.

Acute diarrhea was defined as $\geqslant$3 loose stools during a 24-h period that had lasted for <7 days before presentation. Background information collected included the physician's specialty, practice type, training status, the percentage of patients referred to the physician, the percentage of patients in the practice who were infected with HIV, the number of outpatients seen during the previous 7 days, the number of outpatients with acute diarrhea seen during the previous 7 days, the number of persons hospitalized for treatment of acute diarrhea, and the total number of hospitalized patients treated during the previous 7 days.

The survey focused on the last patient with acute diarrhea seen by the provider, the last patient with bloody diarrhea seen by the provider, and the laboratory tests performed for a routine stool culture. It also included hypothetical scenarios asking whether the physician would order bacterial stool culture or stool ova and parasite (O&P) examination for a 30-year-old patient with 7 different clinical presentations. Pediatricians and a subset of family physicians were sent surveys that differed only by the age of the patient identified in the hypothetical scenarios (3 years old) and a question about the diagnostic evaluation of an ill child attending day care. Researchers in Connecticut and Georgia did not include any questions about O&P testing in their surveys.

Data were entered into Epi-Info, version 6 (CDC, Atlanta, GA), and analysis was conducted in SAS, version 6.11 software (SAS Institute). Differences in proportions were assessed by Fisher's exact test. The χ^2 test was used to assess trends among univariate comparisons. Summary proportions were weighted according to the selection probabilities of the sample frame for each site. Variables that, according to univariate analysis, were associated with a request for a bacterial stool culture, and the first-order interaction terms between these variables were entered into a backward-elimination logistic-regression model, to develop a parsimonious multivariable model. The patient clinical characteristics included in the final model were the objective measures that were most strongly associated with the outcome variable. They were not significantly correlated with each other, yet they showed a high degree of correlation with the excluded clinical characteristic variables. Interaction terms were assessed

using the Wald χ^2 test; $P = .05$ was considered significant. CIs were generated using Fisher's exact method in univariate analyses, and Wald confidence limits were used for the multivariable model. All *P* values shown are 2-tailed. The Hosmer-Lemeshow goodness-of-fit test at the 5% significance level was used to assess the overall fit of the model to the data.

RESULTS

Survey respondents. Of the 5074 surveys mailed, 2839 (56%) were returned with responses. We included in our analysis the 1783 surveys received from physicians who practiced in the surveillance areas, were involved in ⩾8 h of patient care per week, and had treated a patient with acute diarrhea during the previous 12 months (table 1). Eighty-four percent of these respondents were in the specialties of internal medicine (37%), family practice (26%), or pediatrics (21%). Overall, 50% of respondents classified their practice as primarily outpatient fee-for-service, 18% had outpatient health maintenance organizations (HMOs) or managed care practice, 18% had hospital-based practices, and 13% had other types of practices (table 1). Most respondents returned the first mailed survey (1619 physicians [57%]), whereas fewer responded to the second (772 [27%]) or the third mailings (319 [11%]) mailings, and data were missing for 129 (5%).

Evaluation of the last patient seen with acute diarrhea. The majority of these respondents (1301 [73%]) reported having treated at least 1 patient with acute diarrhea during the 7 days before completing the survey, but fewer had sent such a patient to the hospital (1523 [8.5%]) or treated a hospitalized patient for acute diarrhea (187 [10.5%]) during the same time period. Overall, 44% (784 of 1783) of respondents reported requesting a stool culture for a specimen from the last patient seen with acute diarrhea (95% CI, 0.42–0.46). Physicians in Oregon were less likely than those in the other states (California, Connecticut, Georgia, and Minnesota) to report requesting a stool culture for the last patient seen with acute diarrhea (OR, 0.6; 95%, CI 0.5–0.8) (table 2). No such differences were observed among physicians from other states. There were no differences in the proportion of physicians who requested a stool culture according to the month the survey was completed or according to which of the 3 survey mailings was answered.

Physician practice characteristics. The likelihood that a physician requested a stool culture for a stool sample obtained from the last patient seen with diarrhea was evaluated with respect to the physician's practice characteristics (table 2). Data from physicians with outpatient fee-for-service practices were not different from those in outpatient HMO or hospital-based practices in their likelihood to request a stool culture. The likelihood of a stool culture request did increase with the overall percentage of a physician's patients who were referred from another provider and with the proportion of a physician's patients who were known to be infected with HIV. Stool-culture requests were not associated with the number of outpatients

Table 1. FoodNet physician survey response and characteristics of respondents, according to FoodNet site.

	Site					
Category	California	Connecticut	Georgia	Minnesota	Oregon	Total
No. of physicians in selected specialties on licensure list	6990	2907	3441	4014	4301	21,653
Survey response, no. (%) of surveys						
Mailed	1074	1000	1000	1000	1000	5074
Returned	459 (43)	569 (57)	471 (47)	654 (65)	686 (69)	2839 (56)
Used[a]	207	296	274	491	515	1783
Respondent characteristics, proportion of physicians						
By specialty						
Internal medicine	0.38	0.51	0.38	0.24	0.37	0.37
Family practice	0.21	0.09	0.13	0.52	0.31	0.26
Pediatric medicine	0.26	0.22	0.30	0.12	0.12	0.21
Emergency medicine	0.05	0.06	0.07	0.07	0.12	0.07
Ob/Gyn	0.08	0.09	0.08	0.05	0.07	0.07
By practice type						
Outpatient FFS or private practice	0.38	0.60	0.62	0.57	0.48	0.50
Outpatient HMO/managed care	0.24	0.07	0.11	0.21	0.21	0.18
Hospital-based	0.18	0.27	0.18	0.16	0.17	0.18
Other	0.21	0.06	0.09	0.07	0.15	0.13

NOTE. FFS, fee-for-service; HMO, health maintenance organization; Ob/Gyn, obstetrics and gynecology.

[a] Surveys were used only if the respondents practiced in the surveillance area, were involved in patient care an average of ⩾8 h/week, and had seen a patient with acute diarrhea within the 12 months preceding the survey.

Table 2. Proportion of physicians who requested a stool culture for the last patient seen with acute diarrhea.

Variable	No. of respondents	Proportion who requested stool culture (95% CI)	OR (95% CI)	*P*
State				
California	207	0.45 (0.38– 0.52)	1.5 (1.1– 2.0)	.02
Connecticut	296	0.44 (0.39– 0.50)	1.4 (1.1– 2.0)	.01
Georgia	274	0.48 (0.42– 0.54)	1.7 (1.2– 2.4)	<.001
Minnesota	491	0.48 (0.44– 0.53)	1.7 (1.3– 2.2)	<.001
Oregon	515	0.36 (0.31– 0.40)	Reference	Reference
All	1783	0.44 (0.42– 0.46)	NA	NA
Specialty				
Internal medicine	636	0.52 (0.48– 0.56)	2.3 (1.8– 3.1)	<.001
Ob/Gyn	126	0.46 (0.38– 0.55)	1.8 (1.2– 2.8)	.01
Emergency medicine	127	0.44 (0.35– 0.52)	1.6 (1.1– 2.5)	.02
Family practice	449	0.43 (0.39– 0.48)	1.6 (1.2– 2.2)	.001
Pediatric medicine	363	0.32 (0.27– 0.37)	Reference	Reference
Practice type				
FFS or private practice	868	0.45 (0.42– 0.48)	Reference	Reference
HMO/managed care	315	0.45 (0.39– 0.50)	1.0	.9
Hospital-based	315	0.48 (0.42– 0.53)	1.1	.4
Other	224	0.34 (0.28– 0.41)	0.6	<.01
Practice characteristics; % of patients				
Referred from another provider				
0%–4%	376	0.41 (0.37– 0.47)	Reference	Reference
5%–14%	461	0.43 (0.39– 0.48)	1.1	…
⩾15%	458	0.49 (0.45– 0.54)	1.4	.014[a]
With known HIV infection				
0%	167	0.37 (0.30– 0.44)	Reference	Reference
>0% and <1%	675	0.43 (0.40– 0.47)	1.3	…
1%–5%	255	0.55 (0.50– 0.62)	2.1	…
>5%	18	0.45 (0.23– 0.67)	1.4	<.001[a]

NOTE. FFS, fee-for-service; HMO, health maintenance organization; Ob/Gyn, obstetrics and gynecology.

[a] χ^2 Test for linear trend.

seen, the number of outpatients seen who had had diarrhea during the 7 days before the survey, or the physician's participation in a residency training program.

Characteristics of the last patient with diarrhea. The patient characteristics most strongly associated with a stool-culture request were a diagnosis of AIDS (OR, 6.2), bloody stools (OR, 5.8), recent travel in a developing country (OR, 3.8), and a duration of diarrhea of >3 days (OR, 3.2) (table 3). The likelihood of a physician request for a stool culture was associated with subsequent hospitalization (OR, 6.4), referral to (OR, 2.5) or from (OR, 2.7) another physician, and the need for intravenous rehydration (OR, 2.7). If a patient was thought to be part of an outbreak of diarrheal disease, the physician was less likely to request a stool culture (OR, 0.5). Health insurance status was not associated with a stool culture request. In the multivariable model, when physician specialty, state, and the other patient characteristics were controlled for, bloody diarrhea remained strongly associated with a stool-culture request (OR, 11.2; 95% CI, 5.8–21.6), followed by a diagnosis of AIDS (OR, 5.9; 95% CI, 2.5–13.9), and a duration of diarrhea >3 days (OR, 4.8; 95% CI, 3.4–6.9).

Variability in stool-culture request by location and specialty. Substantial variability in stool-culture request practices was demonstrated among physicians in different geographic areas and specialties. In the multivariable model, physicians in Oregon were less likely to request a stool culture than were physicians in other states (OR, 0.5; 95% CI, 0.4–0.7). Differences in physician's diagnostic practices were also shown by the presence of significant interactions in the multivariable model. For example, pediatricians were the specialists most likely to request a culture for patients with bloody diarrhea (94% of patients, vs. 67% for physicians in all other specialties), but pediatricians were least likely to request a culture for patients with nonbloody diarrhea (24% vs. 44% of patients).

Table 3. Characteristics of the last patient seen who had acute diarrhea and the proportion of physicians who requested a stool culture from this patient.

Characteristic	Proportion (%) of physicians who requested stool culture for patient		OR (95% CI)
	Who had characteristic	Who did not have characteristic	
Subsequently hospitalized	88/109 (81)	519/1314 (40)	6.4 (3.9–10.8)
Diagnosis of AIDS	46/56 (82)	681/1592 (43)	6.2 (3.0–13.1)
Bloody stools	145/183 (79)	608/1526 (40)	5.8 (3.9–8.5)
Recent travel to a developing country	56/76 (74)	697/1639 (43)	3.8 (2.2–6.6)
Diarrhea for >3 days	611/1153 (53)	133/508 (26)	3.2 (2.5–4.0)
Referred from another provider	69/102 (68)	608/1603 (48)	2.7 (1.7–4.2)
Received IV rehydration	237/375 (63)	524/1352 (39)	2.7 (2.1–3.5)
Referred to another physician	97/151 (64)	662/1573 (42)	2.5 (1.7–3.6)
Fever	178/320 (56)	560/1344 (42)	1.8 (1.4–2.3)
Abdominal pain	579/1206 (48)	34/460 (7)	1.8 (1.4–2.2)
Had health insurance	662/1471 (45)	44/103 (43)	1.1 (0.7–1.7)
Seen at outpatient visit	647/1521 (43)	114/209 (55)	0.6 (0.5–0.8)
Associated with an outbreak	43/135 (32)	667/1472 (45)	0.5 (0.4–0.8)

Thus, the relationship between specialty and diagnostic practice changed for different levels of a third variable—bloody diarrhea. Another example of interaction involved obstetricians and pediatricians: they were equally likely to request a stool culture for patients with a duration of diarrhea of <3 days, but obstetricians were 4 times more likely to request a stool culture than were pediatricians when the patient had a duration of diarrhea of >3 days (95% CI, 2.1–7.1). In contrast, internists, family physicians, and emergency department physicians were all significantly more likely to request a stool culture than were pediatricians, regardless of the duration of diarrhea. Geographic variability was demonstrated as well: physicians in California and Connecticut, were, on average, 3 times more likely to request a stool culture than were Oregon physicians, but no difference in stool-culture request practices was seen among these physicians for patients with diarrhea lasting >3 days. By comparison, physicians in Minnesota and Georgia were much more likely to request a stool culture than were Oregon physicians, regardless of the duration of diarrhea.

Reasons for requesting a stool culture. Physicians were asked to provide the reason they requested a stool culture for their last patient with diarrhea. For physicians whose last patient had bloody stools, 93% stated that the bloody diarrhea was the reason for requesting a stool culture. Other important reasons for a stool culture request were a diagnosis of AIDS (65% of physicians), a duration of diarrhea of >3 days (61%), presence of fever (39%), and a history of travel in a developing country (38%). These results are consistent with the patient clinical characteristics that were associated with a stool-culture request.

The most common reasons physicians gave for not requesting a stool culture for the last patient seen with diarrhea were an illness of short duration (32%), a belief that a stool culture would not yield a pathogen (25%), the absence of bloody diarrhea (22%), and a belief that culture results would not alter the choice of treatment (12%). These reasons accounted for >89% of the responses. Uncommonly cited reasons for not requesting a stool culture were the cost of the culture (<1%) and patient refusal (<1%).

Diagnostic stool examinations: where tests were performed and which tests were conducted. Ninety-seven percent of respondents reported having requested at least 1 stool culture during the preceding ast year; 27% reported that they requested >10 stool cultures. Twenty-two percent of physicians reported using >1 laboratory for routine stool cultures. Eight percent of respondents reported that their office-based laboratories perform stool cultures, 69% used a local hospital laboratory, and 53% used an independent laboratory. Physicians believed that a routine stool culture included testing for *Salmonella* and *Shigella* species (99% of respondents), *Campylobacter* species (95%), *Escherichia coli* O157:H7 (70%), and *Yersinia* (64%) and *Vibrio* (44%) species. Twenty-eight percent of physicians were uncertain whether *E. coli* O157:H7 was included in a routine stool culture, and >40% were uncertain whether *Yersinia* and *Vibrio* species were included.

Ninety-five percent of respondents reported that they had requested at least 1 stool O&P examination during the preceding year; 27% had requested >10 such examinations. Eighteen percent of physicians reported using >1 laboratory for O&P testing of stools. Eight percent of respondents used their

own office-based laboratories for O&P examinations, 67% used local hospitals, and 42% used an independent laboratory. Many physicians believed that a routine O&P examination included testing for *Giardia lamblia* and *Entamoeba histolytica* (97% of respondents) and *Cryptosporidium* (76%), *Cyclospora* (48%), *Isospora* (53%), and *Microsporidia* (43%) species. However, >40% of respondents reported that they did not know whether parasites other than *Giardia* species and *E. histolytica* were part of a routine test.

Hypothetical patient scenarios. For the hypothetical adult patient scenarios, the percentage of physicians who reported that they would request a stool culture ranged from 26% for a patient with 3 days of nonbloody diarrhea to 98% for a patient with fever and bloody diarrhea (table 4). For the pediatric patient scenarios, the proportion of physicians who would order a stool culture ranged from 7% for a child with 3 days of nonbloody diarrhea to 99% for a child with fever and bloody diarrhea. For adults and children, the additional findings of fever, bloody stools, a diagnosis of AIDS, or a history of travel in a developing country were all associated with an increase in the proportion of physicians who would request a stool culture. The proportion of physicians who would request a stool O&P examination from a hypothetical adult patient ranged from 8% for the patient who had 3 days of nonbloody diarrhea to 94% for a patient with AIDS. For the hypothetical pediatric patients, the proportion who would order an O&P examination ranged from 7% for a child who had 3 days of nonbloody diarrhea to 87% for an afebrile child with a 10-day history of nonbloody diarrhea.

DISCUSSION

To our knowledge, this is the first population-based survey to evaluate the diagnostic practices of physicians in the United States for patients with acute diarrhea. The physicians from which the sample was drawn provided care for ~6% of the total US population and included practitioners in rural and urban areas of the upper Midwest, the South, and both coasts. On the basis of responses to our mail survey, bloody diarrhea, diarrhea lasting >3 day, and a diagnosis of AIDS were the patient factors that were most strongly associated with a stool-culture request. Overall, 44% of physician respondents recalled requesting a stool culture for the last patient seen with acute diarrhea. Significant geographic and specialty differences appeared to exist in diagnostic practices for patients with diarrhea, and a large proportion of physicians was uncertain about what constituted a routine stool examination. These data will allow us to determine better what fraction of acute diarrheal illnesses

Table 4. Proportion of physicians who would request a stool culture for a hypothetical adult ($n = 1211$) and pediatric ($n = 356$) patient with diarrhea,

Hypothetical patient with diarrhea	Percentage of physicians who would request a culture (95% CI)
Aged 30 years	
3-Day history of bloody diarrhea and fever (temp., 38.3°C)	98 (97–98)
3-Day history of nonbloody diarrhea, has AIDS, no fever	94 (93–95)
3-Day history of bloody diarrhea and no fever	93 (91–94)
10-Day history of nonbloody diarrhea and no fever	85 (83–87)
3-Day history of nonbloody diarrhea, traveled in a developing country during the week before illness, no fever	84 (81–96)
3-Day history of nonbloody diarrhea and fever (temp., 38.3°C)	77 (74–79)
3-Day history of nonbloody diarrhea and no fever	26 (23–28)
Aged 3 years	
3-Day history of bloody diarrhea and fever (temp., 38.3°C)	99 (98–100)
3-Day history of bloody diarrhea and no fever	96 (94–98)
3-Day history of nonbloody diarrhea, no fever, and AIDS	95 (92–97)
3-Day history of nonbloody diarrhea, traveled in a developing country during the week before illness, no fever	81 (77–85)
10-Day history of nonbloody diarrhea and no fever	74 (69–78)
3-Day history of nonbloody diarrhea and fever (temp., 38.3°C)	35 (30–40)
3-Day history of nonbloody diarrhea, attends day care, no fever	26 (21–30)
3-Day history of nonbloody diarrhea and no fever	7 (5–10)

NOTE. Data are based on minimum numbers of respondents; the actual number of respondents per question varied slightly. Temp., temperature.

is being measured by public health systems, to estimate better the burden of illness caused by foodborne diarrheal diseases, and to develop educational approaches for providers who treat patients with acute diarrhea.

Public health surveillance for bacterial and parasitic diarrheal diseases depends on clinicians requesting appropriate tests, the identification of pathogens in clinical laboratories, and the reporting of laboratory-confirmed cases to state or local health departments. Understanding the factors that influence physician's diagnostic decisions can reveal the strengths and weakness of our current surveillance system. For example, physicians were most likely to request a stool culture for patients with bloody diarrhea. Diseases that frequently cause bloody diarrhea, such as bacterial dysentery and *E. coli* 0157:H7 infections, are more likely to be detected than diseases that seldom cause bloody diarrhea, under the assumption that that the patient seeks medical care, the proper diagnostic methods are used, and cases are reported by the clinical laboratory. Diseases that seldom cause bloody diarrhea are therefore less likely to be diagnosed and may be underreported. Additionally, the patients for whom stool cultures were most likely to have been ordered were also the most ill, as shown by the strong association between requesting a culture and the need for hospitalization, intravenous rehydration, a consultation with another provider, or a diagnosis of AIDS. As a result, much of what we learn through surveillance data about bacterial diarrhea is from the subsample of those persons who are most ill.

Data from the present survey will aid in developing better estimates of the burden of illness caused by foodborne diarrheal diseases. We found that ~44% of physicians requested a stool culture for persons who sought care for acute diarrhea. Therefore, each stool culture request may represent ~2.3 persons ($1 \div 0.44$) with diarrhea who seek care. By also knowing the proportion of persons who seek care for diarrhea, the proportion of stool cultures that yield a pathogen, and the proportion of confirmed cases that are reported to public health authorities, we can combine these estimates in a sequential manner to evaluate the extent of undiagnosed disease. These data will be necessary to evaluate the full extent of morbidity and the costs attributable to diarrheal diseases.

Data from the present survey are also useful for developing education programs for providers who treat patients with acute diarrhea. For example, the data indicate that physicians were less likely to request a stool culture for patients who are thought to be part of an outbreak, compared with apparent sporadic illnesses. Physicians may assume that, once an outbreak has been recognized, further diagnostic studies are unnecessary, but this is usually not the case. Such a decision is valid only if the cause of the outbreak is already known, if more culture-confirmed cases are not needed to identify the food or water vehicle, if public health authorities are notified of the suspected outbreak, and if treatment of the patient is not likely to be affected by the results of the diagnostic test. For infectious-disease outbreak investigations, each laboratory-confirmed case enhances the power of epidemiologic studies and increases the likelihood that the outbreak's source will be detected and quickly controlled, thus preventing further illness. Therefore, clinicians who are confronted by an apparent increase in the incidence of diarrheal disease should consider increasing, rather than decreasing, the proportion of patients from whom stool samples are obtained, to ensure that the appropriate diagnostic tests for the clinical and epidemiologic situation are ordered, and to notify public health personnel of the apparent outbreak.

Cost considerations, unlike patient clinical characteristics, were not associated with the likelihood of requesting a culture. Among physicians who did not request a stool culture from the last patient with diarrhea, <1% cited cost as the reason. Furthermore, physicians reported that they were as likely to request a stool culture for a patient with health insurance as for a patient without health insurance. Physicians commonly reported that the reason for not requesting a stool culture was that the test was not likely to yield a pathogen or to alter the chosen treatment. These findings indicated that the stool culture's predictive value, rather than simply the cost, influenced the physician's diagnostic choice for patients with acute diarrhea.

The recent increase in the proportion of persons who receive medical care from HMO-based practices and the emphasis on cost-cutting efforts in medical care have raised the possibility that public health surveillance for diarrheal diseases may be vulnerable to cost reductions. A significant reduction in the proportion of patients with diarrhea who have samples tested could have adverse consequences for the recognition, investigation, and control of outbreaks. Our data indicate that physicians in outpatient managed-care practices were as likely to request a stool culture as those in outpatient fee-for-service or private practices. However, because the nomenclature of managed care is rapidly changing and a provider may work under several reimbursement systems simultaneously, misclassification of the physicians' practice type in the survey may have prevented us from thoroughly evaluating this question. Because public health surveillance for diarrheal and foodborne diseases relies on reports of laboratory-confirmed diagnoses, the influence of the changing medical marketplace on physician diagnostic practices deserves further investigation. Also, because the survey was based on self-reported behavior, further data based on actual physician practices are needed.

Some 44% (95% CI, 42%–46%) of physicians reported that they requested a stool culture for the last patient seen with acute diarrhea. In contrast, in a separate FoodNet survey of the general population, 21% of patients with diarrhea reported that a stool culture had been requested for them as a result of

a physician visit [6]. These differing estimates raise the concern that one or both may be an inaccurate reflection of actual physician practice. The physician survey is subject to several factors that may have resulted in an overestimation of the frequency of actual stool-culture practices. First, retrospective self-reported data are subject to recall bias. Physicians may better recall a recent difficult or interesting case or the last patient who had a positive culture result. This could have resulted in a systematic overestimation in the proportion of patients from whom stool samples were obtained. Second, respondents may have tried to anticipate that the "correct" answers to the survey should reflect the practice that stool culturing is desirable. Finally, respondents may have been more interested in diarrheal diseases than were nonrespondents and, thus, more likely to request stool cultures for patients with diarrhea. The FoodNet Working Group is planning a clinic-based follow-up study to further evaluate the proportion of physicians who request a stool culture for patients with diarrhea.

Our survey provided an opportunity to evaluate factors that might account for differences in physician diagnostic practices for patients with diarrhea. Although we expect that such practices differ according to the patients' age, health status, and epidemiologic context, these data also indicate variability caused by other reasons. For example, the association between the probability of a stool culture request and the duration of diarrhea was different depending on the state where the physician practices, even after controlling for specialty, patient characteristics, or practice type. Furthermore, these differences did not appear to be due to variation in the rates of diarrhea or in the rates of care seeking for diarrhea, because these rates were not different among the 5 FoodNet sites (CDC FoodNet population survey, unpublished data). These differences in stool-culture ordering practices are likely due to differences in practice style or habits that are not explained by specialty, patient characteristics, or practice type. Variability in practice style may be an indication that an evidence-based approach to the diagnosis of diarrhea would be of benefit to clinicians, patients, and public health practitioners. Such a guideline for infectious diarrhea has been recently published [7].

Our data indicate that physicians often do not know which pathogens are detected in stool examinations. The vast majority of physicians reported that a "routine" stool culture included techniques that would identify *Salmonella, Shigella,* and *Campylobacter* species. This finding was confirmed by a survey of clinical laboratories in FoodNet catchment areas, which showed that 99% of laboratories surveyed routinely cultured for these pathogens in stool specimens (CDC, unpublished data). However, a high proportion of physicians (28%) did not know whether a routine culture would detect *E. coli* O157:H7. In a separate analysis of these data, a high proportion of physicians (up to 77% in California) mistakenly believed that a routine stool culture would test for *E. coli* O157:H7 when, in fact, the laboratory method used would not yield this pathogen [8]. Furthermore, >40% of respondents did not know whether *Yersinia* or *Vibrio* species were included in a routine stool culture, or whether parasites such as *Cryptosporidia* or *Cyclospora* species would be detected by a routine O&P examination. Insufficient physician knowledge of which organisms are detected by routine stool examinationss could have negative consequences for patient care and public health. If a provider incorrectly assumes that a negative stool culture result has excluded infection with an important organism from the differential diagnosis, treatment and follow-up recommendations may be misguided. Likewise, the opportunity to diagnose an infection of public health importance may be missed. To avoid this mistake, providers should be made aware of what tests a routine examination includes and should insist that such examinations include the organisms of epidemiologic importance in that area. The CDC recommends that all bloody stools be cultured for *Salmonella, Shigella,* and *Campylobacter* species and *E. coli* O157:H7 [9]. However, not all bacterial diarrhea is caused by these organisms, and, if another organism is suspected, a specific request usually must be made to include it in the diagnostic examination. Education programs for health care providers about the use of the clinical laboratory for diagnosis of acute diarrhea could help to address these concerns.

Although diarrhea is a common complaint among outpatients, surprisingly few data exist to guide an evidence-based approach to its diagnosis and treatment. The predictive value of a diagnostic test for stool is dependent on the test's sensitivity and specificity, as well as the organism's prevalence in the population being evaluated. Future investigations could focus on evaluating these parameters, to provide clinicians with better information for decision making. Those who apply guidelines for acute diarrheal disease to their own clinical practice should consider the various uses of a stool test result, as data for therapeutic and follow-up plans, as a guide for patient education needs, in providing antimicrobial sensitivity data, and in meeting the public health needs of notifiable disease surveillance and outbreak detection.

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